Impact of prognostic factors on outcome in patients with severe head trauma

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There is an obvious need to predict outcome of severe head trauma as early as possible. The era of computerized tomography (CT) and a better understanding of the influence of prognostic factors on the outcome of severe head trauma have materially improved our ability to predict outcome. Age, Glasgow comma score (GCS), CT findings and postoperative complications are strongly associated with outcome.[1] This study was designed to specifically analyze the outcomes associated with individual indicants, which may help in identifying high-risk group for death as well as reducing the complications.

We retrospectively examined patients with severe head trauma that were unable to follow commands after cardiopulmonary resuscitation admitted during the period from June 1995 to December 1996 to the Neurosurgical Department of a 750-bedded tertiary care hospital serving a low socio-economic community located centrally in the metropolitan city of Karachi, Pakistan. Informed consent was taken from hospital authority and approval was taken from the Research Ethics Committee. The patients included in the study were unable to follow commands after successful cardiopulmonary resuscitation, those cases, apneic on arrival and fulfilling the criteria of brain death were excluded. Data was obtained from medical records, CT scan reports, surgeons' records and patient follow up records. First-day emergency room neurological assessments were also taken into account while analyzing the data. The predictable factors taken into consideration were age, GCS, pupillary response to light described as abnormal only when bilaterally absent, motor response, surgical mass lesion recorded when the patient required craniotomy for evacuation of an intra or extra axial lesion, CT scan findings and non neurological factors such, as somatic injuries and medical complications, postoperative complications including recurrent bleeding, infection and cerebrospinal fluid leakage. Data was reported as mean $\pm$ standard deviation, percentages, rates and proportions. Chi-square statistics were used for comparison among different categorical predictors and outcome variables. A p value of less than 0.05 was considered to indicate statistical significance. A database was constructed in Microsoft Excel to record all relevant information while analysis was carried out using Epi-Info 6, version 6.02.

Out of 199 patients included in the study, 165 (83%) were male and 34 (17%) were female, giving a male to female ratio of 4.85:1. The mean age was 28.9 $\pm$ 16. The outcome associated with prognostic indicators is summarized in **Table 1**. Regarding neurosurgical factors, all patients $\geq$41 years (53%) had a poor outcome, whereas 70% of patients <20 years of age had a good outcome (p<0.05). Patients with high and low GCS scores showed a significant difference (p<0.05). Scores between 3 and 5 did well in only 22% while high scores of 9 to 15 showed good outcome in 86%. Surgical decompression was associated with a good outcome in 74% of cases with the first craniotomy while it dropped to 46% with the second craniotomy (p<0.05). In the CT findings, patients with high-density lesions had a good outcome in 67% of cases (p<0.05), however, combined high-density lesions were associated with poorer outcome (only 41% good moderate disability) and a high mortality (p<0.05). Patients with postoperative complications did well in only 43% of cases, while those without complications had a good outcome in 63% cases (p<0.05), and it was depicted with high (48%) mortality rate in patients with complications. Motor posturing was associated with a poorer outcome in 50% of cases (p<0.05). A significant (p<0.05) downward trend in good outcome was demonstrated in groups of patients with no posturing (64% good outcome), and unilateral or bilateral posturing (36%). Only 31% of patients with impaired pupillary reactions had good outcome, as compared with 65% of those with normal responses (p<0.05). Regarding non-neurosurgical factors, only 17% of patients associated with medical complications made a good recovery (p<0.05). In a group without complications, 65% of patients had a good outcome. Somatic injuries were not good predictors of outcome.

There is no single factor that can accurately predict patient outcome following severe head trauma. In a clinical setting, predictive indicators of outcome can never be perfect because of the unpredictable influence of non-neurological factors on the final outcome. Our data pertaining to the predictive power of prognostic indicators was generally compatible with those reported by Prasad et al,[2] although difference in handling of the data made direct comparison difficult. Similarly, recent reports described the same findings.[3-5] The significance of GCS reported in our study is similar to the findings of other recent studies.[3] Our findings of mortality rates associated with low GCS are consistent with several other studies, which emphasized individual cases of patients appearing to be fatally injured who make a meaningful neurological recovery. Some cases suggest the value of aggressively treating patients with poor neurological presentation. Impaired pupillary response and motor posturing has a well-documented association with a poor outcome,[6] that also reinforced the results of our study. Our findings of a poor prognostic significance of combined high-density lesion requiring surgical decompression have also been previously demonstrated,[7] however, note that a 46% drop in good outcome was associated with second craniotomy. Thus, 51% of patients who did not have surgery had a good

Table 1 - Outcome associated with different neurosurgical/non-neurosurgical prognostic factors (N=199).

Neurosurgical prognostic factors	Total cases	Outcome %			
		G/MD*	SD/V**	Dead	*P* value
Age (years)					
0-20	66	70	12	18	<0.05
21-40	97	66	12	22	<0.05
41-80	36	30	12	53	<0.05
>80	-	-	-	-	
GCS score					
3-5	50	22	18	60	<0.05
6-8	85	65	15	20	<0.05
9-15	64	86	6	8	<0.05
Pupillary reaction					
Normal	173	65	12	22	<0.05
Bilaterally impaired	26	31	19	50	<0.05
Surgical compression					
None	100	51	20	29	<0.05
Once	90	74	4	22	>0.05
Twice	7	28	28	4	<0.05
CT scan findings					
Intra cerebral only	150	67	13	20	<0.05
Combined high density lesion	49	41	14	45	<0.05
Postoperative complications					
None	178	63	13	23	<0.05
Complications	21	43	9	48	<0.05
Motor posturing					
None	177	64	13	24	<0.05
Unilateral or bilateral	22	36	14	50	<0.05
Non-neurosurgical prognostic factors					
Medical complications					
None	181	65	13	21	<0.05
Complications	18	17	11	72	>0.05
Somatic injuries					
None	178	61	13	26	>0.05
Injuries	21	57	14	28	>0.05

*Good moderate disability, ** Severe disability, vegetative
GCS - Glasgow comma score, CT - computerized tomography

outcome compared to 28% of those who had surgery twice (**Table 1**). The CT scan study is used primarily to assist in the day-to-day management of the head injured patient, but the information thus obtained can also be used to improve prognostication. Non-neurological factors, such as associated somatic injuries and medical complications did not perform well in this study. This finding does not imply that the presence of non-neurological factors is of low prognostic significance.[5]

In conclusion, the most significance indicators in predicting outcome were clinical data and CT scan findings, which ultimately helped clinicians to improve outcome and reduce complications as well as mortality.

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